ALCHEMY, ANCIENT AND MODERN.

Alchemy: Ancient and Modern: Being a Brief Account of the Alchemistic Doctrines, and their Relations, to Mysticism on the One Hand, and to Recent Discoveries in Physical Science on the Other Hand, together with some particulars regarding the Lives and Teachings of the most noted Alchemists. By H. Stanley Redgrove. Pp. xiv+141. (London: W. Rider and Son, Ltd., 1911.) Price 4*s.* 6*d.* net.

THE author of this book thinks he perceives in the trend of modern chemical doctrine an approximation to the fundamental dogmas of philosophical alchemy, as these were understood and taught by its greatest exponents. The application of the principles of evolution to the genesis of the chemical elements has, in his opinion, brought us back to the "basic idea" permeating all alchemistic theory, and that, in his judgment, the time is gone when it may be regarded as legitimate to point to alchemy as an instance of the aberrations of the human mind. How far the general proposition is, or can be, substantiated by the facts of experiment at present known to us, may be seriously questioned. It is practically certain that no proof of transmutation has ever been given. Allegations of such an occurrence have been made, of course, times without number. But whenever any instance of the kind has been properly scrutinised, the allegation has been wholly disproved, and the evidence that it has been made in bad faith and as the result of conscious fraud, and not merely of honest self-deception, is, in a large number of instances, complete and irrefutable.

Does the evidence to be obtained from modern experimental inquiry place the "basic idea" on any surer foundation? Mr. Redgrove evidently thinks it does. Otherwise the *raison d'être* of his book is gone. He is, he tells us, not only a student of chemistry, but also of "what may be generalised under the terms Mysticism and Transcendentalism"; and he hopes that this unusual combination of studies has enabled him to take what he calls a broad-minded view of the theories of the alchemists, and to adopt a sympathetic attitude towards them. No one can possibly object to Mr. Redgrove taking a broad-minded view of anything—certainly not of chemical theory, whether ancient or modern. But theories in chemistry stand or fall by facts. The ancient alchemists certainly never proved their theories. Have the modern alchemists done any better?

That there is such a thing as the philosophy of alchemy is undoubted. Some of the earlier followers of the art were men whose names are not merely hallowed by a hoary antiquity, but who are known from their writings and by the testimony of their contemporaries to be earnest, thoughtful philosophers, actuated by the true spirit of science. It is difficult to believe that such men were not influenced by some guiding principle, and that they followed their calling simply as empirics. That many of them were churchmen, and some of them mystics, has lent colour to the supposition that they regarded alchemy as a form of transcendentalism, and the general character of certain of their writings may be pointed to in proof of such a view. But although at various periods in the history of alchemy there were men—John Dee was such a man—whose conduct and mode of study were largely influenced by their predilection towards occultism, it is quite certain that by far the greater number of adepts were swayed by the most mundane and even the most sordid of considerations. However desirous we may be to share Mr. Redgrove's sympathy and broad-mindedness, we fail to perceive that he has done anything towards the elucidation of the philosophy of alchemy. He has advanced no view that has not already been presented and examined, and he has given no facts that are not to be found in other works, such as those of Kopp, Hoefer, Figuier, Gerding, or the more recent publications of Mr. Waite. Davy once said that analogy was the fruitful parent of error. The author has been actuated by an analogy which is fundamentally unsound and treacherous.

There is really no evidence that modern science is permeated by the spirit of alchemy, and, therefore, strictly speaking, there is no meaning in the phrase "modern alchemy." The fact is, Mr. Redgrove has been led away by an inconstant and wandering affection. He will learn in time, if he does not already know it, that he cannot serve two mistresses, and that he had better be off with the old love before he is on with the new. At the moment his true love for chemistry has been somewhat obscured by an illicit, but we trust transient, affection for that Delilah named Mysticism, and the present book is apparently the product of his mixed emotions. He had better return to chemistry, and give her his undivided allegiance. As he knows her more thoroughly he will learn to appreciate her whole-heartedly. There is not much romantic fascination about her; she has nothing of the glamour of mysticism; indeed, she tends to be rather matter-of-fact, but then that is one of her strongest points.

There is a certain type of mind from which the facts slip off like the proverbial water from the duck's back, but which nevertheless prides itself on its receptivity for "broad views." The views are frequently made so very broad that they have actually no depth. It is only to this type of mind that Mr. Redgrove's book can appeal.

THEORIES OF THE AETHER.

A History of the Theories of Aether and Electricity from the Age of Descartes to the Close of the Nineteenth Century. By Dr. E. T. Whittaker, F.R.S. Pp. xiv+475. (London: Longmans, Green and Co.; Dublin: Hodges, Figgis and Co., Ltd., 1910.) Price 12*s.* 6*d.* net.

WHEN we turn to an historical survey of electrical theory we are usually entertained by reprints showing scenes like the Abbé Nollet demonstrating the properties of an electrified boy, but the present work contains more satisfactory evidences of first-hand knowledge of the authorities. It traces carefully the growth, during three centuries, of optical and electrical science, more especially in rela-

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tion to the theory of the æther. As regards mathematical calculations, space is saved by expressing results in vector notation, as well as by numerous references to the original memoirs; the treatment of the more important advances, without being exhaustive, is sufficiently adequate to define them clearly in their historical setting, that being the proper function of a work of this type.

Two-thirds of the book are devoted to the period ranging from Descartes to Maxwell. For most students this will probably be the more valuable portion, epitomising work which is not easily accessible.

Dr. Whittaker makes an interesting addition to the history of the law of electrostatic attraction between two charged particles. The law of inverse square of the distance is commonly ascribed to Coulomb, on account of his direct verification by means of the torsion balance (1785). When the researches of the Hon. Henry Cavendish were edited by Maxwell in 1879, it was seen that the same law had been established by a different method as early as 1773; on referring to early literature, such as Young's "Lectures," it appeared that the unpublished work of Cavendish was quite unknown to his contemporaries. Dr. Whittaker directs attention to a still earlier statement in Priestley's "History of Electricity," published in 1767. It appears that Priestley, following Franklin, had made experiments which showed that, when a hollow metallic vessel is electrified, there is no charge on the inner surface, and no electric force in the air inside. Priestley then continues:

> "May we not infer from this experiment that the attraction of electricity is subject to the same laws with that of gravitation, and is therefore according to the squares of the distances; since it is easily demonstrated that were the earth in the form of a shell, a body in the inside of it would not be attracted to one side more than another?"

The chapter on elastic solid theories covers an important period. Cauchy, who was first in the field, obtains full credit for his various theories; although one sees how his work failed to stimulate later writers, especially of the English school. Dr. Whittaker remarks that his point of view in the earlier theories appears to have been: Given the equations of vibration of an elastic solid, what boundary conditions must be used in order to obtain Fresnel's results? It was Green who first showed that with a properly localised energy function, the Lagrangian method gave not only the equations of motion, but also the correct boundary conditions.

Some attention is paid to the æther of Cauchy's third theory of reflection, better known as the contractile æther of Lord Kelvin. The form of energy function used by Lord Kelvin might have been noticed; after beginning with the ordinary form for an elastic solid, he transformed it, by integrating by parts, into a form similar to that of MacCullagh's theory. One would consider this form as properly localised, not for the contractile æther, but for a medium specified to be rotationally elastic.

In the later portion of the book mechanical theories are treated further under the more modest description of models of the æther; there are also chapters on the followers of Maxwell, on conduction in solutions and gases, and on more recent theories of æther and electrons. These give a general account of various lines of advance since the time of Maxwell; in particular one notices the problem of relative motion of the earth and the æther, leading to a consideration of the nature of systems of measurement of space and time. The period of the book closes with the æther still endowed with a certain degree of substantiality, however different it may be from ordinary matter. In view of more recent developments based on the theory of relativity, Dr. Whittaker's treatise appears at an opportune time; it forms an important and valuable aid to a comparative study of theories of the æther.

T. H. H.

DISEASES OF ECONOMIC PLANTS.

Diseases of Economic Plants. By Prof. F. L. Stevens and J. G. Hall. Pp. x+513. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 8*s.* 6*d.* net.

THIS book is primarily intended for those who wish to recognise—without having recourse to the microscope—and then to combat fungous diseases of cultivated plants. Descriptions are given of the prominent characteristics of the most destructive diseases of fruit and vegetables cultivated in the United States, as well as information regarding the latest methods of prevention or cure. All the best bulletins of the numerous State agricultural experimental stations and of the U.S. Department of Agriculture have been examined for facts; the authors have had the help also of various specialists in reading over the proofs of certain parts, *e.g.* Dr. Erwin F. Smith has thus assisted with the bacterial diseases, Dr. L. R. Jones with potato diseases, and so forth. Short, clear, scientific descriptions are given of the various life-stages of the species of fungi causing plant diseases; these are accompanied by practical advice as to the methods to be employed against each stage by the grower. In many cases, *e.g.* in that of the onion "smut" and of the "common scab" of the potato, and of the various diseases of the apple, the account given is a model of what should be provided by the man of science for the practical man. Clear directions are given for the making and application of fungicides, and also useful information on the subject of spraying machinery. It would have been well, however, to have supplied fuller information on the subject of "Bordeaux injury," and how it may be avoided. Practical details are given of the disinfection of seeds by the use of formaldehyde gas, and the various methods of soil disinfection are discussed. It is pointed out that the presence in land of such ineradicable soil diseases as the melon, cowpea, cotton, or tobacco "wilt," onion "smut," cabbage "black rot," &c., may result in a depreciation of 50 per cent. or more in the market value of the land. In dealing with many of the diseases of cereals, pea, bean, lettuce, celery, potato, carnation, violet, asparagus, grape, strawberry, and other fruits the authors are not content with merely

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